HIGH DESERT
POWER PROJECT LLC
www.HIGHDESERTPOWER.com

March 16, 2006

Mr. Steve Munro
Compliance Project Manager
California Energy Commission
1516 9th Street, MS 2000
Sacramento, CA 95814-5512

Subject: **<u>Addendum 2</u>**
<u>Petition for Revisions/Administrative Changes to Soil & Water - 4</u>
<u>Commission Decision (97-AFC-1C)</u>
<u>High Desert Power Project, LLC</u>

Dear Mr. Munro:

High Desert Power Project (HDPP) is enclosing the following information as addendum 2 to the subject petition submitted for approval on September 30, 2005:

- Total Dissolved Solids (TDS) data and calculations to support operation of the Aquifer Banking System (ABS) for 40 % of the year. See Attachment A.
- Manufacturer's information regarding operating effectiveness/efficiency and reliability of the UV system. See Attachment B.
- Revised Addendum 1 (Cover Letter and Pages A-1 and A-2) to address corrections to projected injection rate and other typos. See Attachment C. Addendum 1 was originally submitted on February 20, 2006.

As documented in Attachment A, 40 % ABS operation is HDPP's projection based on the following data and assumptions:

- Monthly grab sample TDS data from check 41 from 1/1989 through 12/05,
- 85% operational availability of ABS equipment,
- 2 weeks per year the ABS is unavailable due to plant outage, and
- 4 weeks every 15 years that SWP water is unavailable due to MWA maintenance.

Per recent discussion with the CEC, it is difficult to predict with certainty future operation of the ABS system based on past TDS data. Therefore, to address the possibility of future ABS banking interruptions, Constellation will work with CEC on a plan with specific milestones or injection goals to ensure that banking is proceeding as projected. The plan will include provisions or actions to be implemented by HDPP in the event that banking is not progressing to meet the requested schedule.

HDPP believes this letter and attachments include all additional information necessary to complete the review of the petition. Per recent discussions with CEC, HDPP anticipates a decision by June 15, 2006.

Should you have any questions or need additional information, please contact me at (949) 425-4755.

Sincerely,

R. Garcia R.

Ramiro R. Garcia
Environmental Director – West Region
Constellation Energy

Attachments

cc: Mr. Greg Cash
RWQCB – Lahontan Region
14440 Civic Drive, Suite 200
Victorville, CA 92392-2306.

Steve Gross, Constellation Energy
Dave Boward, HDPP
Steve Shulder, Constellation Energy
Jon Boyer, HDPP
Facility File: 2.1.11 (ABS Correspondence)

Attachment A

Total Dissolved Solids (TDS) Data and Calculations to Support 40 % Operation of the Aquifer Banking System (ABS)

Calculations to Support 40 % ABS Operation

Year	Annual Injected TDS Average (mg/l) (1)	Number of Months of Operation	Number of Months with Data (2) (3)
1989	240	4	12
1990	N/A (4)	0	11
1991	N/A (4)	0	10
1992	N/A (4)	0	12
1993	229	6	12
1994	N/A (4)	0	12
1995	222	10	12
1996	237	11	11
1997	232	12	12
1998	215	11	11
1999	236	11	11
2000	243	12	12
2001	N/A (4)	0	12
2002	N/A (4)	0	12
2003	229	7	12
2004	248	5	12
2005	243	12	12
Totals		101	198

Notes:

(1) - The annual TDS average is based on the TDS value from Check 41 and the average TDS value added from the treatment system (22.5 mg/l).

(2) - The calculations are based on historical data, since some of the months do not have any data, they were not included in the total months of potential operation.

(3) - There were several months where more than one sample was taken. The assumption was made that if any of the samples were above the treatment level no injection occurred during that month.

(4) - No injection occurred during any month of this year.

Total months in which ABS could have operated using historical data: 101

Total number of months with data during which the ABS could have potentially run: 198

Percent of Time that ABS could potentially be run = 0.51

A. Assumption 1 - The ABS system will not operate for 1 week during each plant outage due to any numberof reasons including, black plant condition, no personnel available to operate ABS, major repairs on ABS, etc.

HDPP outage time will cause ABS to be down 2 weeks/year

Down time for 17 years of historical data =	34	weeks
	8	months
Available Time for ABS Operation =	93	months

The available time for ABS operation is the total months in which ABS could be operated using historical data minus the number of months of down time during plant outages.

B. Assumption 2 - The SWP system will be down for maintenance for an estimated 1 week every 5 years and 2 weeks every 10 years, for a total of 4 weeks during the 17 year period.

Down time (4 weeks/4.3 weeks per month)	1	months
Available Time for ABS Operation =	92	months

The available time for ABS Operation is the available time for ABS operation from A) Assumption 1 minus the down time for the SWP maintenance periods.

C. Assumption 3 - The ABS system will not be available for operation at all times due to maintenance and testing requirements when the system could otherwise have been operating. The base assumption is that the system will be available 85 percent of the when called upon.

Operational Availability =	0.85	
Available Time for ABS Operation =	78	months

The available time for ABS Operation is the available time for ABS operation from B) Assumption 2 times the percent operational availability.

Percent of Time that ABS could be run after Operational Availability factored in =	0.40

This result is the 78.34 months of estimated ABS system operation divided by the total number of months with data that the ABS could be run from the historical data (198 months).

Check 41 Monthly TDS Grab Sample Data from 1/89 through 12/05

Date	TDS Level (mg/l)	Monthly + Avg Treatment (mg/l)
1/18/1989	416	438.5
2/15/1989	385	407.5
3/15/1989	485	507.5
4/19/1989	179	201.5
5/17/1989	373	395.5
6/21/1989	308	330.5
7/19/1989	328	350.5
8/16/1989	227	249.5
9/20/1989	274	296.5
10/18/1989	191	213.5
11/15/1989	329	351.5
12/13/1989	386	408.5
1/18/1990	423	445.5
2/21/1990	355	377.5
3/21/1990	323	345.5
4/18/1990	375	397.5
5/16/1990	333	355.5
6/20/1990	376	398.5
7/18/1990	351	373.5
8/15/1990	304	326.5
9/19/1990	231	253.5
10/17/1990	243	265.5
11/14/1990	328	350.5
3/28/1991	481	503.5
4/17/1991	455	477.5
5/15/1991	448	470.5
6/19/1991	394	416.5
7/17/1991	408	430.5
8/21/1991	417	439.5
9/18/1991	366	388.5
10/16/1991	428	450.5
11/20/1991	388	410.5
12/18/1991	409	431.5
1/15/1992	480	502.5
2/26/1992	454	476.5
3/18/1992	453	475.5
4/15/1992	494	516.5
5/20/1992	360	382.5
6/17/1992	376	398.5
7/15/1992	374	396.5
8/19/1992	384	406.5
9/16/1992	436	458.5
10/21/1992	434	456.5
11/18/1992	474	496.5
12/16/1992	479	501.5
1/20/1993	508	530.5
2/17/1993	577	599.5
3/17/1993	593	615.5
4/21/1993	454	476.5

Date	TDS Level (mg/l)	Monthly + Avg Treatment (mg/l)
5/19/1993	354	376.5
6/16/1993	342	364.5
7/21/1993	240	262.5
8/18/1993	176	198.5
9/15/1993	138	160.5
10/20/1993	199	221.5
11/17/1993	189	211.5
12/15/1993	299	321.5
1/19/1994	261	283.5
2/16/1994	345	367.5
3/16/1994	352	374.5
4/20/1994	379	401.5
5/3/1994	311	333.5
5/18/1994	319	341.5
6/15/1994	353	375.5
7/20/1994	330	352.5
8/17/1994	310	332.5
9/21/1994	399	421.5
10/19/1994	481	503.5
11/16/1994	461	483.5
12/21/1994	398	420.5
1/18/1995	404	426.5
2/15/1995	314	336.5
3/15/1995	259	281.5
4/19/1995	313	335.5
5/17/1995	163	185.5
6/21/1995	103	125.5
7/19/1995	172	194.5
8/16/1995	214	236.5
9/20/1995	178	200.5
10/18/1995	197	219.5
11/15/1995	147	169.5
12/20/1995	251	273.5
2/21/1996	258	280.5
3/20/1996	225	247.5
4/17/1996	209	231.5
5/15/1996	292	314.5
6/19/1996	228	250.5
7/17/1996	211	233.5
8/21/1996	221	243.5
9/18/1996	154	176.5
10/16/1996	149	171.5
11/20/1996	192	214.5
12/18/1996	215	237.5
1/13/1997	217	239.5
2/19/1997	80	102.5
3/19/1997	152	174.5
4/16/1997	240	262.5
5/21/1997	244	266.5

Date	TDS Level (mg/l)	Monthly + Avg Treatment (mg/l)
6/18/1997	227	249.5
7/16/1997	179	201.5
8/20/1997	218	240.5
9/17/1997	159	181.5
10/15/1997	184	206.5
11/19/1997	332	354.5
12/17/1997	277	299.5
1/21/1998	345	367.5
2/18/1998	317	339.5
3/18/1998	334	356.5
4/15/1998	No data	No data
5/20/1998	89	111.5
6/17/1998	73	95.5
7/15/1998	114	136.5
8/19/1998	219	241.5
9/2/1998	No data	No data
9/16/1998	198	220.5
10/21/1998	139	161.5
11/18/1998	137	159.5
12/16/1998	152	174.5
1/20/1999	234	256.5
2/17/1999	223	245.5
3/17/1999	143	165.5
4/21/1999	230	252.5
5/19/1999	249	271.5
6/16/1999	230	252.5
7/21/1999	193	215.5
8/18/1999	157	179.5
9/15/1999	166	188.5
11/17/1999	257	279.5
12/15/1999	266	288.5
1/19/2000	309	331.5
2/16/2000	280	302.5
3/15/2000	192	214.5
4/19/2000	210	232.5
5/17/2000	243	265.5
6/21/2000	219	241.5
7/19/2000	207	229.5
8/16/2000	208	230.5
9/20/2000	167	189.5
10/18/2000	226	248.5
11/15/2000	255	277.5
12/20/2000	326	348.5
1/17/2001	378	400.5
2/21/2001	341	363.5
3/21/2001	271	293.5
4/18/2001	275	297.5
5/16/2001	265	287.5
6/20/2001	271	293.5
7/10/2001	319	341.5
7/18/2001	262	284.5
8/1/2001	209	231.5
8/15/2001	246	268.5
9/19/2001	327	349.5
10/17/2001	362	384.5

Date	TDS Level (mg/l)	Monthly + Avg Treatment (mg/l)
11/14/2001	329	351.5
12/5/2001	312	334.5
12/19/2001	313	335.5
1/16/2002	348	370.5
2/20/2002	247	269.5
3/21/2002	275	297.5
4/17/2002	274	296.5
5/15/2002	277	299.5
6/19/2002	291	313.5
7/17/2002	227	249.5
8/21/2002	309	331.5
9/18/2002	383	405.5
10/23/2002	384	406.5
11/20/2002	333	355.5
12/16/2002	368	390.5
1/15/2003	350	372.5
2/5/2003	324	346.5
2/19/2003	257	279.5
3/19/2003	264	286.5
4/16/2003	219	241.5
5/14/2003	299	321.5
6/18/2003	181	203.5
7/16/2003	183	205.5
8/20/2003	169	191.5
9/17/2003	176	198.5
10/15/2003	253	275.5
11/19/2003	302	324.5
12/17/2003	338	360.5
1/21/2004	278	300.5
3/17/2004	261	283.5
3/17/2004	264	286.5
4/21/2004	221	243.5
5/04	259	281.5
6/04	277	299.5
7/04	203	225.5
8/04	200	222.5
9/04	245	267.5
10/04	311	333.5
11/04	289	311.5
12/04	292	314.5
1/05	326	348.5
2/05	244	266.5
3/05	298	320.5
4/05	172	194.5
5/05	258	280.5
6/05	118	140.5
7/05	161	183.5
8/05	195	217.5
9/05	215	237.5
10/05	190	212.5
11/05	231	253.5
12/05	323	345.5

Attachment B

Manufacturer's information Regarding
Operating Effectiveness or Efficiency of the UV system

CALGON
CALGON CARBON CORPORATION

500 Calgon Carbon Dr.
Pittsburgh, PA,
USA 15205♦
Engineered Solutions

March 14, 2006

Constellation Energy

Attention: Steve Shulder

Reference: **Supply of Ultraviolet Disinfection Equipment**

Dear Steve,

Further to your request for additional information please find to follow our response.

1. **Reliability and maintenance requirements?** Calgon Carbon's UV systems are not very labor intensive as most of the components are non-moving and the automatic cleaning system reduces the need for operator involvement. The main requirement will be the replacement of lamps which are warranted for 5,000 operating hours and should be replaced after 5,000 operating hours. To remove and replace one lamp takes about 10 minutes. Additionally, the sensors should be calibrated approximately once per month to ensure that the system is "reading" the UV intensity correctly. This takes about 10 minutes per sensor. The O & M manual previously provided goes into greater detail.

2. **Brief list of customers of drinking water systems that include the date of installation and daily gallons treated?** Please see attached reference list.

3. **A definition of three log removal effectiveness?** The reactors we have proposed have been validated with the protocol described in the U.S. EPA Draft Disinfection Guidance Manual. This protocol insures that the system as designed will achieve the disinfection objectives as stated by the manufacturer. In this case, we can achieve three log inactivation of cryptosporidium (99.9 % inactivation) with an MS-2 dose of 42 mJ/cm^2. These treatment parameters have been specified by the U.S. EPA and are extremely conservative. Please find attached a summary validation report which details the flow, UVT, and dose capabilities of the reactor. Please consider this information as confidential. A complete report can be supplied on award of contract, or the signing of a confidentiality agreement.

4. **Elimination of the need to use chlorine injection to maintain cleanliness of a pipe and well injection system?** The U.S. EPA recommends the use of chlorine in drinking water system distribution lines even if UV is in use because UV treatment provides no residual disinfection activity. Drinking water distribution lines are likely much longer than in your case and they often have dead zones that require residual disinfection to prevent fouling and pathogen growth. There are many industrial applications where chemical biocides and anti-fouling chemicals have been completely replaced by UV but this is case sensitive.

I trust this answers your questions. If you require any additional information please do not hesitate to contact me.

Yours truly,

David DesRochers

David DesRochers P.Eng.
Regional Sales Manager– UV Technologies
Calgon Carbon Corporation

Sentinel® Partial Installation List
March, 2006

Plant name: WSSC - Potomac WFP (Laurel, MD)
Peak Flow: 300 MGD
Equipment Model: (12) 9 X 20 kW Reactor
Reactor Size: 48"
Installation Date: 2006-2007
Status: Design
Surface Water

Plant name: Chetwynd Water Treatment Plant, BC, Canada
Peak Flow: .8 MGD
Equipment Model: (2) 3 X 4 kW Reactor
Reactor Size: 12"
Installation Date: Late 2005
Status: Design
Surface Water

Plant name: Trimark Communities Water Treatment Plant (Mountain House, CA)
Peak Flow: 5 MGD
Equipment Model: (2) 6 X 4 kW Reactor
Reactor Size: 18"
Installation Date: Mid-2005
Status: Delivered
Surface Water

Plant name: Trimark Communities Water Treatment Plant (Mountain House, CA)
Peak Flow: 15 MGD
Equipment Model: (2) 6 X 10 kW Reactor
Reactor Size: 36"
Installation Date: Mid-2006
Status: Delivered
Surface Water

Plant name: Groveland
(Groveland, CA)
Peak Flow: 2.3 MGD
Equipment Model: (4) 6 X 4 kW Reactor at two plants
Reactor Size: 18"
Installation Date: Late-2006
Status: Delivered
Surface Water

Plant name: Cal Water
(Bakersfield, CA)
Peak Flow: 2 MGD
Equipment Model: (1) 4 X 1 kW Reactor
Reactor Size: 12"
Installation Date: Mid-2006
Status: Delivered
Groundwater treatment non potable water

Plant name: Bear Gulch
(Bear Gulch, CA)
Peak Flow: 5 MGD
Equipment Model: (2) 6 X 4 kW Reactor
Reactor Size: 36"
Installation Date: February 2006
Status: Delivered
Surface Water

Plant name: Campbell River Water System, BC, Canada
Peak Flow: 20 MGD
Equipment Model: (2) 6 X 20 kW Reactor
Reactor Size: 48"
Installation Date: Late 2005
Status: Under Fabrication
Surface Water

Plant name: Rouse Hill RWP (Sydney Australia)
Peak Flow: 3 MGD
Equipment Model: (1) 8 X 4 kW Reactor
Reactor Size: 18"
Installation Date: Late 2005
Status: Under Fabrication
Wastewater Reuse

Plant name: Fena Water Treatment Plant (Guam)
Peak Flow: 15 MGD
Equipment Model: (2) 3 X 10 kW Reactor
Reactor Size: 36"
Installation Date: Late 2005
Status: Under Fabrication
Surface Water

Plant name: Deacon Booster Pump Station, Winnipeg, MB
Peak Flow: 206 MGD
Equipment Model: (6) 9 X 20 kW Reactor
Reactor Size: 48"

Installation Date: Installed
Status: Partially Operating
Surface Water

Plant name: City of Brandon WTP, MB
Peak Flow: 21.4 MGD
Equipment Model: (3) 8 X 4 kW Reactor
Reactor Size: 18"
Installation Date: Installed
Status: Operating
Surface Water

Plant name: Ft. Drum, Gouveneur, NY
Peak Flow: 3.6 MGD
Equipment Model: (1) 4 X 4 kW Reactor
Reactor Size: 18"
Installation Date: First Half, 2005
Status: Delivered, awaiting installation & commissioning
Surface Water

Plant name: City of Kelowna, B.C., Canada
Peak Flow: 48.8 MGD
Equipment Model: (3) 6 X 20 kW and (1) 4 X 4 kW Reactors
Reactor Size: 48"and 18"
Installation Date: Late 2005
Status: Delivered, awaiting installation & commissioning
Surface Water

Plant name: City of Kelowna, B.C., Canada
Peak Flow: 20 MGD
Equipment Model: (2) 6 X 20 kW
Reactor Size: 48"
Installation Date: Late 2006
Status: In production
Surface Water

Plant name: Orillia Water Filtration Plant (Orillia, Ontario)
Peak Flow: 11 MGD
Equipment model: (3) 8 X 4 kW reactors
Reactor size: 18"
Installation date: July 2005
Status: Under Installation
Surface Water

Plant name: Rossdale Water Treatment Plant, Edmonton, Alberta
Peak Flow: 79.3 MGD

Equipment model: (9) 3 X 10 kW reactors
Reactor size: 36"
Installation date: May 2004
Status: Operational
Surface Water

Plant name: Lac La Biche Water Treatment Plant, Lac La Biche, Alberta
Peak Flow: 4.4 MGD
Equipment model: (2) 8 X 4 kW reactors
Reactor size: 18"
Installation date: January 2004
Status: Operational
Surface Water

Plant name: Hulton Plant, Oakmont, PA
Peak Flow: 10 MGD
Equipment model: (2) 4 X 4 kW reactors
Reactor size: 24"
Installation date: April 2004
Status: Operational
Surface Water

Plant name: Louden County Sanitary, Leesburg, VA
Peak Flow: 12 MGD
Equipment model: 6 X 10 kW reactor
Reactor size: 36"
Installation date: July 2005
Status: Under Fabrication
Surface Water - reclaim water using Sentinel drinking water UV disinfection reactors

Plant name: Woolner Wells, ON (Regional Municipality of Waterloo ONT)
Peak Flow: 3 MGD
Equipment model: 6 X 4 kW reactor
Reactor size: 18"
Installation date: June 2003
Status: Operational
Ground Water

Plant name: Mannheim, ON (Regional Municipality of Waterloo ONT)
Peak Flow: 19.2 MGD
Equipment model: Two (2) 6 X 20 kW reactors
Reactor size: 48"
Installation date: February 2003
Status: Operational
Surface Water

Plant name: E.L. Smith Plant: Edmonton, AB
Peak Flow: 95 MGD
Average Flow: 45 MGD
Equipment Model: Three (3) 6 X 20 kW reactors
Reactor Size: 48"
Installation date: March of 2002
Status: Operational
Surface Water

Plant name: Canmore, AB
Peak Flow: 2.2 MGD
Equipment model: Two (2) 4 X 4 kW reactors (one redundant)
Reactor size: 24"
Installation date: March of 2002
Status: Operational
Surface Water

Plant name: Moon Township, PA
Peak Flow: 5.5 MGD
Average Flow: 3.3 MGD
Equipment model: Four 2 X 4 kW reactors
Reactor size: 12"
Water source: Ohio River
Installation date: 1st Quarter 2003
Status: Operational
Surface Water

Plant name: Bowling Green, Ohio
Peak Flow: 12 MGD
Average Flow: 5 MGD
Equipment model: 6 X 4 kW
Reactor size: 24"
Installation date: May 2000
Status: Operational
Surface Water

Plant name: West View Water, PA
Peak Flow: 40 MGD
Average Flow: 22 MGD
Equipment model: 6 X 20 kW
Reactor size: 48"
Installation date: March 2001
Status: Operational
Surface Water

Plant name: Grosse Pointe Farms, MI
Peak Flow: 14 MGD
Average Flow: 4.5 MGD
Equipment model: 6 X 4 kW
Reactor size: 24"
Installation date: May 2000
Status: Operational
Surface Water

Plant name: TSK, Japan
Average Flow: 1 MGD
Equipment model: 2 X 4 kW
Reactor size: 12"
Installation date: Feb. 2003
Status: Operational
Ground Water

Plant name: United Water, NY
Average Flow: 1 MGD
Equipment model: Two 4x1 kW
Reactor size: 12"
Installation date: Oct. 2002
Status: Operational
Ground Water

Plant Name: Frackville, PA
(Pennsylvania American Water Work Company)
Peak Flow: 1 MGD
Model: 4x1 kW
Reactor Size: 12”
Status: Operational
Surface Water

This summary report is **CONFIDENTIAL** and was prepared for Calgon Carbon Corporation by Carollo Engineers and is the property of Calgon Carbon Corporation and **SHOULD NOT BE PRINTED, COPIED**, or **DISTRIBUTED** without the express written permission of Calgon Carbon Corporation.

Calgon Carbon Corporation
18-INCH SENTINEL REACTOR
SUMMARY REPORT

UV REACTOR VALIDATION AT THE PORTLAND, OR UV VALIDATION FACILITY

March 2004

carollo engineers

12592 WEST EXPLORER DRIVE, SUITE 200 • BOISE, IDAHO 83713 • (208) 376-2288 • FAX (208) 376-2251

SUMMARY REPORT

A Sentinel UV reactor manufactured by Calgon Carbon Corporation (CCC), Pittsburg, PA, was validated at a test facility located in Portland, OR. The reactor consisted of eight 4.5 kW mercury lamps oriented horizontal and perpendicular to flow within an 18-inch flanged cylindrical reactor. The reactor was equipped with baffle plates to optimize reactor hydraulics, an automated mechanical wiper system, and ultraviolet (UV) intensity sensors. Lamps were powered and controlled as pairs using four power supplies (ballasts) (i.e., each power supply powered two lamps). Ballast operating input power input varied from 3 to 10 kW.

The reactor was validated with inlet piping that included a 90-degree bend located three pipe diameters upstream of the reactor. Velocity profiles were measured one foot upstream and one foot downstream of the reactor. The challenge microbe was MS2 phage and the UV absorber was lignin sulphonate (LSA). The dose-response of the MS2 phage was within the bounds described by the USEPA and NWRI/AwwaRF Guidelines for UV validation. Static mixers were used to ensure additives were well mixed upstream of the reactor inlet sampling port and the microbes surviving disinfection were well mixed upstream of the reactor effluent sampling port.

The test conditions of flow rate, UV transmittance at 254 nm (UVT), and lamp output were designed to validate both dose delivery and monitoring by the UV reactor operating with 2, 4, 6, and 8 lamps. MS2 phage reduction equivalent dose (RED) and UV intensity were measured at various lamp power settings at flow rates ranging from 1.25 to 10 mgd and at UVT at 254 nm ranging from 70 to 95 percent. Power settings were adjusted to give RED values varying from 20 to 60 mJ/cm^2.

UV intensity, measured by the duty UV sensor calibrated by comparison to DVGW reference sensors, was analyzed as a function of UVT (from 70 to 95 percent adjusted using LSA) and ballast operating power setting (from 3 to 10 kW). Using multi-variate analysis, the following equation was derived for the UV intensity measured by the duty sensor:

$$S = 10^{-15.290} \times UVT^{8.3679} \times P_L^{\left(2.9506 - 0.031877 \times UVT + 1.4578 \times 10^{-4} \times UVT^2\right)}$$

Equation 1.1

Where: S is the measured UV intensity in W/m^2, UVT is the water UV transmittance at 254 nm, and P_L is the ballast input power setting in kW. The equation was used to predict the UV sensor reading at a 10 kW ballast input power setting as:

$$S = 10^{-15.290} \times UVT^{8.3679} \times 10^{\left(2.9506 - 0.031877 \times UVT + 1.4578 \times 10^{-4} \times UVT^2\right)}$$

Equation 1.2

These equations describe the UV intensity measured with new lamps in a new, unfouled sleeve being monitored by a calibrated UV sensor through a clean monitor port window. This equation can be used to interpolate over the range of UVT and ballast power values measured during validation but must not be used for extrapolation outside this range. These equations can be compared to measurements made at a water treatment plant (WTP) to assess the relative output of the lamps compared to the data measured during validation.

RED measured during validation was analyzed by determining an empirical equation relating RED to measured flow, UVT, and UV intensity. Multi-variate analysis was used to fit the RED data to:

$$\mathrm{RED} = 10^{\mathrm{A}} \times \mathrm{UVA}^{\mathrm{B}} \times \left(\frac{S / S_{10\mathrm{kW}}}{\mathrm{Q}} \right)^{\mathrm{C} + \mathrm{D} \times \mathrm{UVA} + \mathrm{E} \times \mathrm{UVA}^2}$$

Equation 1.3

Where: S_{10kw} is the sensor reading predicted using equation 1.2, Q is the flow in mgd, and UVA is the UV absorbance coefficient in cm^{-1}. Table 1.1 gives the coefficients for the fits. The equations defined using these coefficients can be used for sizing the UV reactor for a given design flow, UVT, and lamp output and can be used to define dose monitoring using either the UV intensity alarm setpoint approach or the calculated dose monitoring approach. For dose monitoring, the lowest UV intensity measured with the operating lamps should be used in the equation. If the equations are used to define the UV intensity alarm setpoint monitoring approach, the relationship between RED and measured flow and UV intensity divided by flow should use a default UVT value that gives a conservative estimation of dose delivery over the range of UVT that occurs with the application. These equations can be used to interpolate over the range of flow, UVT, and UV intensity measured during validation testing and indicated in Table 1.1. They must not be used to interpolate outside that range.

Table 1.1	Coefficients used to Define RED as a Function of Measured Flow, UVT, and UV Intensity							
Lamps	Flow rate Range, Q (mgd)	UVT Range (%)	S/Q Range (W/m2)	Coefficients				
				A	B	C	D	E
2	1.25 - 5.0	85 - 95	38 - 116	0.81638	-0.76098	0.57974	0	0
4	1.25 - 10	70 - 95	8.9 - 53	0.51720	-1.2484	1.0844	-8.4141	34.545
6	1.25 - 10	70 - 95	7.2 - 34	0.78588	-1.1826	1.0640	-7.4752	32.199
8	1.25 - 10	70 - 95	4.3 - 25	1.0618	-1.0857	1.0340	-5.7939	23.872

Data collected during validation and information provided by CCC indicated that the 18-inch Sentinel reactor used in this test met USEPA proposal draft UV Disinfection Guidance Manual (UVDGM) (June 2003) Tier 1 UV reactor criteria with the exception of the criteria on UV sensor viewing location along the length of the lamp. The operation and validation of the UV reactor performance, as measured during this validation test, met Tier 1 criteria for REDs greater than 22 mJ/cm^2. At lower REDs, the validation did not meet Tier 1 criteria on the uncertainty of interpolation of the RED as a function of flow rate, UVT, and UV intensity.

Using Tier 2 methodology given in the USEPA proposal draft UVDGM (June 2003), Table 1.2 gives the MS2 RED predicted using Equation 1.3 required to show 2.0, 2.5, and 3.0 log inactivation of *Cryptosporidium* for the following four cases:

1. UV Intensity Alarm Setpoint Monitoring, Tier 2 analysis using the RED bias calculated using the average MS2 phage dose-response observed during validation and the total uncertainty calculated using confidence intervals of interpolation

2. UV Intensity Alarm Setpoint Monitoring, Tier 2 analysis using the RED bias calculated using the most resistant MS2 phage dose-response observed during validation and the total uncertainty calculated using prediction intervals of interpolation

3. Calculated Dose Monitoring, Tier 2 analysis using the RED bias calculated using the average MS2 phage dose-response observed during validation and the total uncertainty calculated using confidence intervals of interpolation

4. Calculated Dose Monitoring, Tier 2 analysis using the RED bias calculated using the most resistant MS2 phage dose-response observed during validation and the total uncertainty calculated using prediction intervals of interpolation

Table 1.2 RED Values Required for 2.0, 2.5, and 3.0 log Inactivation of *Cryptosporidium* Based on Tier 2 Analysis (June 2003 Draft UVDGM)

Calculated Dose Monitoring Approach												
	Based on safety factors determined using the average RED bias and total uncertainty (%) calculated using the confidence interval of interpolation											
# Lamps	2			4			6			8		
Crypto log inactivation	2.0	2.5	3.0	2.0	2.5	3.0	2.0	2.5	3.0	2.0	2.5	3.0
MS2 RED (mJ/cm^2)	18	22	29	18	22	28	18	22	28	18	22	29
	Based on safety factors determined using the peak RED bias and total uncertainty (%) calculated using the prediction interval of interpolation											
# Lamps	2			4			6			8		
Crypto log inactivation	2.0	2.5	3.0	2.0	2.5	3.0	2.0	2.5	3.0	2.0	2.5	3.0
MS2 RED (mJ/cm^2)	19	25	31	18	24	31	19	24	31	18	24	31
UV Intensity Alarm Setpoint Dose Monitoring												
	Based on safety factors determined using the average RED bias and total uncertainty (%) calculated using the confidence interval of interpolation											
# Lamps	2			4			6			8		
Crypto log inactivation	2.0	2.5	3.0	2.0	2.5	3.0	2.0	2.5	3.0	2.0	2.5	3.0
MS2 RED (mJ/cm^2)	18	22	28	18	21	28	18	21	28	18	21	28
	Based on safety factors determined using the peak RED bias and total uncertainty (%) calculated using the prediction interval of interpolation											
# Lamps	2			4			6			8		
Crypto log inactivation	2.0	2.5	3.0	2.0	2.5	3.0	2.0	2.5	3.0	2.0	2.5	3.0
MS2 RED (mJ/cm^2)	19	24	31	18	23	30	18	24	30	18	24	30

While the current proposed draft UVDGM specifies using the confidence intervals of interpolation in the Tier 2 analysis, prediction intervals may be considered more appropriate by some jurisdictions. The RED bias calculated using the most UV resistant MS2 phage was only between 3 and 4.5 percent greater than the RED bias calculated using the average dose-response.

These results apply to the reactor specified in this report. Important information on the reactor design that impacts dose delivery and monitoring is provided. Detailed drawings and specifications on the 18-inch Sentinel UV reactor referenced in this report are available from CCC.

The 18-inch Sentinel UV reactor was validated under the third party oversight of Carollo Engineers, P.C. Microbial oversight was provided by Clancy Environmental Consultants (CEC). UV transmittance measurements were checked using NIST-traceable UV absorbance standards. Analysis of the validation data was based on the proposal draft USEPA UVDGM (June 2003). This report can be updated to reflect any future changes in the UVDGM that arise from response to public comments on the draft.

Attachment C

Revised Addendum 1

HIGH DESERT
POWER PROJECT LLC
WWW.HIGHDESERTPOWER.com

March 10, 2006

Mr. Steve Munro
Compliance Project Manager
California Energy Commission
1516 9th Street, MS 2000
Sacramento, CA 95814-5512

Subject: **<u>Addendum 1</u>**
<u>Petition for Revisions/Administrative Changes to Soil & Water - 4</u>
<u>Commission Decision (97-AFC-1C)</u>
<u>High Desert Power Project, LLC</u>

Dear Mr. Munro:

High Desert Power Project (HDPP) is enclosing the following information as an addendum to the subject petition submitted for approval on September 30, 2005:

- Additional information to support the requested extension (Attachment A);
- Brief description of other alternatives currently being evaluated by HDPP to address the current ABS issues and expedite banking (Attachment B). The information in Attachment B is not the basis for the petition for extension and is included as information only. As discussed, HDPP will update the CEC as we make progress on the evaluation of the alternatives and if any of the listed alternatives is more appropriate to address the ABS issues and expedite banking; and
- Schedule to complete evaluation of alternatives (Attachment C).

As detailed in Attachment A, HDPP is requesting an extension until January 1, 2016 to meet the current ground water injection requirement (13,000 AF) based on the following and other assumptions listed in attachment A:

- current annual average treatment levels for Total Dissolved Solids (TDS) and Trihalomethanes (THM);
- installation of UV disinfection system to minimize THM formation and allow HDPP to meet the current THM annual average treatment level of 0.5 ug/L; and
- net annual injection rate of 1,148 AF/yr.

As demonstrated in the original petition, the proposed revisions

- will not result in an adverse impact to the groundwater quality;
- will allow HDPP more flexibility to (i) continue minimizing aquifer impact during periods of elevated TDS and (ii) meet the current ground water injection requirement of 13,000 acre-feet.
- do not affect compliance with applicable laws, ordinances, regulations, or standards (LORS).

Accordingly, HDPP requests the Energy Commission Staff to expedite review of this petition, and request Commission approval of the proposed revisions in accordance with Title 20 CCR §1769(a)(3).

Per our conversations, in an effort to expedite the approval of the extension, HDPP is planning on scheduling a meeting with you and others at the CEC during the week of February 27, 2006 to review and answer any questions you may have on this submittal.

In the meantime, should you have any questions or need additional information, please contact me at (949) 425-4755.

Sincerely,

R. Garcia R.

Ramiro R. Garcia
Environmental Director – West Region
Constellation Energy

Attachments

cc: Mr. Greg Cash
RWQCB – Lahontan Region
14440 Civic Drive, Suite 200
Victorville, CA 92392-2306.

Steve Gross, Constellation Energy
Dave Boward, HDPP
Steve Shulder, Constellation Energy
Jon Boyer, HDPP
Facility File: 2.1.11 (ABS Correspondence)

Attachment A

Additional Information to Support Requested Extension

Per Soil & Water 4 of the CEC Decision, HDPP is required to inject 13,000 acre-feet (AF) into the aquifer over the first five years of commercial operation. As of December 31, 2005, HDPP has injected approximately 2,706 acre-feet. As detailed below, HDPP is requesting an extension until January 1, 2016 to meet the current ground water injection requirement of 13,000 acre-feet (AF).

Below are the assumptions and calculations of the additional years to achieve a net injection of 13,000 AF.

Assumptions

- Current treatment levels for TDS and THM
- Installation of UV disinfection system to minimize THM formation and allow HDPP to meet the current THM annual average treatment level of 0.5 ug/L
- ABS can operate 40 % of the time per year after the UV system has been installed. The 40 % is based on the average TDS levels from 1989 to 2004. It will take about 44 weeks to install the UV system after approval of petition. See UV System Description and Installation Schedule included at the end of this Attachment. Therefore, will assume only three months of operation for the rest of 2006 and 40 % of the time starting in 2007.
- 0.5 % Water Dissipation (Loss) thru end of 2005 (Based on Modeling Results)
- 1.0 % Water Dissipation (Loss) Rate after 2005 (Based on HDPP Projection)
- Water banked as of 12/31/05 = 2,706 AF
- Design injection flow rate= 2,150 gal/min = 9.5 AF/day
- Aquifer Banking System Capacity Factor = 85% (expected injection system operating rate)
- Extraction for well testing and development - 12 AF per year (Based On Past System Operation)
- Extraction to support Plant operation. Approximately 19 AF/yr calculated as 13.25 AF/day * 7 days / 5 years. Aqueduct is shutdown for maintenance for approximately 7 days once every five years. This represents the total volume of make-up cooling water needed during the 7 days when the SWP water is not available to HDPP, prorated over the 5 year period between maintenance downtimes.

Calculations

Net Water Banked as of 12/31/05

Net banked thru 2004 as calculated by the CEC = 1, 924 AF
Net banked in 2005 @ 0.5 % loss = 763.3 AF

=> Net water banked as of 12/31/05 = 2,687.3 AF

Estimated Net Water Banking for 2006

= (Design Injection Flow Rate, AF/day) * (Injection Capacity factor, %) * (90 days) – (extraction to support plant operation and well development) – (water dissipation @ 1.0 % loss/year)
= (9.5 AF/day) * (0.85) * (90 days) – (12 AF + 19 AF) – water dissipation @ 1 %
= 695 AF

Estimated Net Water Banked thru 2006

= (Water Banked thru 2005 + Estimate for 2006)
= 2,687.3 AF + 695 AF
= 3,382 AF

Net Annual Injection (excluding dissipation)

= (Design Injection Flow Rate, AF/day) * (Injection Capacity factor, %) * (365 days/yr) * (% Injection) – (extraction to support plant operation and well development)
= (9.5 AF/day) * (85 %) * (365 days/yr) * (40 %) – (12 AF + 19 AF)
= 1,148 AF/yr

Additional Years Required to Bank 13,000 AF after January 1, 2007.

Year	Year Start Volume	End of Year Loss	Quantity Injected During Year	End of Year Volume
	(acre-feet)	(acre-feet)	(acre-feet)	(acre-feet)
1	3,382	34	1,148	4,496
2	4,496	45	1,148	5,599
3	5,599	56	1,148	6,691
4	6,691	67	1,148	7,772
5	7,772	78	1,148	8,843
6	8,843	88	1,148	9,902
7	9,902	99	1,148	10,951
8	10,951	110	1,148	11,990
9	11,990	120	1,148	13,018